Oxford Dendrochronology Laboratory
Report 2025/10

The Tree-Ring Dating of samples from the House and Barn Chicory Lane Farm, 246 Brush Mountain Road, Spring Mills, Centre County, Pennsylvania

Dr D W H Miles FSA and Michael Cuba

Summary:

Spring Mills, Centre Co; Chickorylane (40.876182º N; -77.547081º W)

(a) Barn *Felling dates:* **Winter? 1803/4**

(b) House *Felling dates:* **Winter 1817/18**

(a) *ex situ* posts 1801(1), 1803(1C?); (b) Log joists 1817(2C, 11C, 14C,15C^2, 18C,19C,24C), 1816(15); Axial beam 1817(21C). *Site Master* CLSx 1612-1817 (*t* = 9.96 ALLENS; 7.88 PA006; 7.86 SEEPA; 7.02 EASTPA).

The two-story, log house appears to have been laid out in the plan of what is commonly called a continental plan, or stove-room house, or *Flurkuchenhaus*. The hallmarks of this plan are a kitchen running the entire width of the house along one gable end. An off-center chimney mass typically defines the plan with a parlor on the opposite side of the chimney. The chimney is no longer extant in this house but there is some evidence for its location in the basement. The parlor is often heated by a five-plate, jamb stove which is fed from the kitchen side. This allows for the parlor to be well heated without any smoke. A smaller, unheated bedchamber is typically arranged next to the parlor. The ends of carrying beams can be seen at the east gable end where the wall defining the parlor and bedchamber spaces would have been.

Date sampled: 19th November 2024

Owner and Commissioner: Catherine and John Smith

Historical Research: Catherine Smith

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How Dendrochronology Works

Dendrochronology has over the past 20 years become one of the leading and most accurate scientific dating methods. Whilst not always successful, when it does work, it is precise, often to the season of the year. Tree-ring dating to this degree of precision is well known for its use in dating historic buildings and archaeological timbers. However, more ancillary objects such as doors, furniture, panel paintings, and wooden boards in medieval book-bindings can sometimes be successfully dated.

The science of dendrochronology is based on a combination of biology and statistics. Fundamental to understanding of how dendrochronology works is the phenomenon of tree growth. Essentially, trees grow through the addition of both elongation and radial increments. The elongation takes place at the terminal portions of the shoots, branches, and roots, while the radial increment is added by the cambium, the zone of living cells between the wood and the bark. In general terms, a tree can be best simplified by describing it as a cone, with a new layer being added to the outside each year in temperate zones, making it wider and taller.

An annual ring is composed of the growth which takes place during the spring and summer and continues until about November when the leaves are shed, and the tree becomes dormant for the winter period. For the two principal American oaks, the white and red (*Quercus alba* and *Q. rubra*), as well black ash (*Fraxinus nigra*), and many other species, the annual ring is composed of two distinct parts: the spring growth or early wood, and the summer growth, or late wood. Early wood is composed of large vessels formed during the period of shoot growth which takes place between March and May, before the establishment of any significant leaf growth. This is produced by using most of the energy and raw materials laid down the previous year. Then, there is an abrupt change at the time of leaf expansion around May or June when hormonal activity dictates a change in the quality of the xylem, and the summer, or late wood is formed. Here the wood becomes increasingly fibrous and contains much smaller vessels. Trees with this type of growth pattern are known as ring-porous, and are distinguished by the contrast between the open, light-coloured early wood vessels and the dense, darker-coloured late wood.

Other species of tree are known as diffuse-porous, and this group includes the tulip, or yellow-poplar (*Liriodendron tulipifera L.*). Unlike the ring-porous trees, the spring vessels consist of a very small spring vessels which become even smaller as the tree advances into the summer growth. The annual growth rings are often very difficult to distinguish under even a powerful microscope, and one often needs to study the medullary rays, which thicken at the ring boundaries.

Dendrochronology utilises the variation in the width of the annual rings as influenced by climatic conditions common to a large area, as opposed to other more local factors such as woodland competition and insect attack. It is these climate-induced variations in ring widths that allow calendar dates to be ascribed to an undated timber when compared to a firmly-dated sequence. If a tree section is complete to the bark edge, then when dated a precise date of felling can be determined. The felling date will be precise to the season of the year, depending on the degree of formation of the outermost ring. Therefore, a tree with bark which has the spring vessels formed but no summer growth can be said to be felled in the spring, although it is not possible to say in which particular month the tree was felled.

Another important dimension to dendrochronological studies is the presence of sapwood and bark. This is the band of growth rings immediately beneath the bark and comprises the living growth rings which transport the sap from the roots to the leaves. This sapwood band is distinguished from the heartwood by the prominent features of colour change and the blocking of the spring vessels with tyloses, the waste products of the tree's growth. The heartwood is generally darker in colour, and the spring vessels are usually blocked with tyloses. The heartwood is dead tissue, whereas the sapwood is living, although the only really living, growing, cells are in the cambium, immediately beneath the bark. In the American white oak (*Quercus* alba), the difference in colour is not generally matched by the change in the spring vessels, which are often filled by tyloses to within a year or two of the terminal ring. Conversely, the spring vessels in the American red oak (*Q* rubra) are almost all free of tyloses, right to the pith. Generally, the sapwood retains stored food and is therefore attractive to insect and fungal attack once the tree is felled and therefore is often removed during conversion.

Methodology: The Dating Process

All timbers sampled were of oak (*Quercus* spp.) from what appeared to be primary first-use timbers, or any timbers which might have been re-used from an early phase. Those timbers which looked most suitable for dendrochronological purposes with complete sapwood or reasonably long ring sequences were selected. *In situ* timbers were sampled through coring, using a 16mm hollow auger. Details and locations of the samples are given in the summary table.

The dry samples were sanded on a linisher, or bench-mounted belt sander, using 60 to 1200 grit abrasive paper, and were cleaned with compressed air to allow the ring boundaries to be clearly distinguished. They were then measured under a x10/x30 microscope using a travelling stage electronically displaying displacement to a precision of 0.01mm. Thus, each ring or year is represented by its measurement which is arranged as a series of ring-width indices within a data set, with the earliest ring being placed at the beginning of the series, and the latest or outermost ring concluding the data set.

As indicated above, the principle behind tree-ring dating is a simple one: the seasonal variations in climate-induced growth as reflected in the varying width of a series of measured annual rings is compared with other, previously dated ring sequences to allow precise dates to be ascribed to each ring. When an undated sample or site sequence is compared against a dated sequence, known as a reference chronology, an indication of how *good* the match is must be determined. Although it is almost impossible to define a visual match, computer comparisons can be accurately quantified. Whilst it may not be the best statistical indicator, Student's (a pseudonym for W S Gosset) *t*-value has been widely used amongst British dendrochronologists. The cross-correlation algorithms most commonly used and published are derived from Baillie and Pilcher's CROS programme (Baillie and Pilcher 1973), although a faster version (Munro 1984) giving slightly different *t*-values is sometimes used for indicative purposes.

Generally, *t*-values over 3.5 should be considered to be significant, although in reality it is common to find demonstrably spurious *t*-values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some *t*-value ranges of 5, 6, or higher, and for these to be well replicated from different, independent chronologies with local and regional chronologies well represented. Users of dates also need to assess their validity critically. They should not have great faith in a date supported by a handful of *t*-values of 3's with one or two 4's, nor should they be entirely satisfied with a single high match of 5 or 6. Examples of spurious *t*-values in excess of 7 have been noted, so it is essential that matches with reference chronologies be well replicated, and that this is confirmed with visual matches between the two graphs. Matches with *t*-values of 10 or more between individual sequences usually signify having originated from the same parent tree.

In reality, the probability of a particular date being valid is itself a statistical measure depending on the *t*-values. Consideration must also be given to the length of the sequence being dated as well as those of the reference chronologies. A sample with 30- or 40-years growth is likely to match with high *t*-values at varying positions, whereas a sample with 100 consecutive rings is much more likely to match significantly at only one unique position. Samples with ring counts as low as 50 may *occasionally* be dated, but only if the matches are very strong, clear, and well replicated, with no other significant matching positions. This is essential for intra-site matching when dealing with such short sequences. Consideration should also be given to evaluating the reference chronology against which the samples have been matched: those with well-replicated components which are geographically near to the sampling site are given more weight than an individual site or sample from the opposite end of the country.

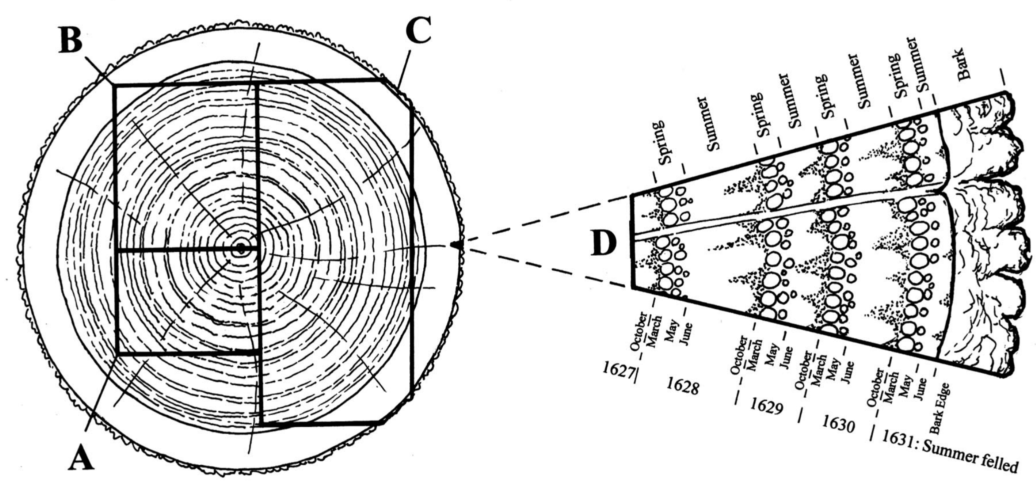
It is general practice to cross-match samples from within the same phase to each other first, combining them into a site master, before comparing with the reference chronologies. This has the advantage of averaging out the 'noise' of individual trees and is much more likely to obtain higher *t*-values and stronger visual matches. After measurement, the ring-width series for each sample is plotted as a graph of width against year on log-linear graph paper. The graphs of each of the samples in the phase under study are then compared visually at the positions indicated by the computer matching and, if found satisfactory and consistent, are averaged to form a mean curve for the site or phase. This mean curve and any unmatched individual sequences are compared against dated reference chronologies to obtain an absolute calendar date for each sequence. Sometimes, especially in urban situations, timbers may have come from different sources and fail to match each other, thus making the compilation of a site master difficult. In this situation samples must then be compared individually with the reference chronologies.

Therefore, when cross-matching samples with each other, or against reference chronologies, a combination of both visual matching and a process of qualified statistical comparison by computer is used. The ring-width series were compared on an IBM compatible computer for statistical cross-matching using a variant of the Belfast CROS program (Baillie and Pilcher 1973). A version of this and other programmes were written in BASIC by D Haddon-Reece and re-written in Microsoft Visual Basic by M R Allwright and P A Parker.

Ascribing and Interpreting Felling Dates

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. For samples which have sapwood complete to the underside of, or including bark, this process is relatively straight forward. Depending on the completeness of the final ring, i.e. if it has only the early wood formed, or the latewood, a *precise felling date and season* can be given.

Where the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then the question of when the tree was felled becomes considerably more complicated. In the European oaks, sapwood tends to be of a relatively constant width and/or number of rings. By determining what this range is with an empirically or statistically-derived estimate is a valuable aspect in the interpretation of tree-ring dates where the bark edge is not present (Miles 1997). The narrower this range of sapwood rings, the more precise the estimated felling date range will be.



Section of oak tree with conversion methods showing three types of sapwood retention resulting in **A** *terminus post quem*, **B** a felling date range, and **C** a precise felling date. Enlarged area **D** shows the outermost rings of the sapwood with growing seasons (Miles 1997, 42)

Unfortunately, it has not been possible to apply an accurate sapwood estimate to either the white or red oaks at this time. Primarily, it would appear that there is a complete absence of literature on sapwood estimates for oak anywhere in the country (Grissino-Mayer, *pers comm*). The matter is further complicated in that the sapwood in white oak (*Quercus alba*) occurs in two bands, with only the outer ring or two being free of tyloses in the spring vessels (Gerry 1914; Kato and Kishima 1965). Out of some 50 or so samples, only a handful had more than 3 rings of sapwood without tyloses. The actual sapwood band is differentiated sometimes by a lighter colour, although this is often indiscernible (Desch 1948). In archaeological timbers, the lighter coloured sapwood does not collapse as it does in the European oak (*Q robur*), but only the last ring or two without tyloses shrink tangentially. In these circumstances the only way of being able to identify the heartwood/sapwood boundary is by recording how far into the timber wood boring beetle larvae penetrate, as the heartwood is not usually susceptible to attack unless the timber is in poor or damp conditions. Despite all of these drawbacks, some effort has been made in recording sapwood ring counts on white oak, although the effort is acknowledged to be somewhat subjective.

As for red oaks (*Quercus rubra*) it will probably not be possible to determine a sapwood estimate as these are what are known as 'sapwood trees' (Chattaway 1952). Whereas the white oak suffers from an excess of tyloses, these are virtually non-existent in the red oak, even to the pith. Furthermore, there is no obvious colour change throughout the section of the tree, and wood-boring insects will often penetrate right through to the centre of the timber. Therefore, in sampling red oaks, it is vital to retain the final ring beneath the bark, or to make a careful note of the approximate number of rings lost in sampling, if any meaningful interpretation of felling dates is to be made.

Similarly, no study has been made in estimating the number of sapwood rings in tulip-poplar or black ash, or for any of the pines.

Therefore, if the bark edge does not survive on any of the timbers sampled, then only a *terminus post quem* or *felled after* date can be given. The earliest possible felling date would be the year after the last measured ring date, adjusted for any unmeasured rings or rings lost during the process of coring.

Some caution must be used in interpreting solitary precise felling dates. Many instances have been noted where timbers used in the same structural phase have been felled one, two, or more years apart. Whenever possible, a *group* of precise felling dates should be used as a more reliable indication of the *construction period*. It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure under study. However, it is common practice to build timber-framed structures with green or unseasoned timber and that construction usually took place within twelve months of felling (Miles 1997).

Details of Dendrochronological Analysis

The results of the dendrochronological analysis for the building under study are presented in a number of detailed tables. The most useful of these is the summary **Table 1**. This gives most of the salient results of the dendrochronological process, and includes details for each sample, its species, location, and its felling date, if successfully tree-ring dated. This last column is of particular interest to the end user, as it gives the actual year and season when the tree was felled, if bark is present, and an estimated felling date range if the sapwood was complete on the timber but some was lost in coring, or a *terminus post quem*. Often these *terminus post quem* dates begin far earlier than those with precise felling dates. This is simply because far more rings have been lost in the initial conversion of the timber.

It will also be noticed that often the precise felling dates will vary within several years of each other. Unless there is supporting archaeological evidence suggesting different phases, all this would indicate is either stockpiling of timber, or of trees which have been felled or died at varying times but not cut up until the commencement of the particular building operations in question. When presented with varying precise felling dates, one should always take the *latest* date for the structure under study, and it is likely that construction will have been completed for ordinary vernacular buildings within twelve or eighteen months from this latest felling date (Miles 1997).

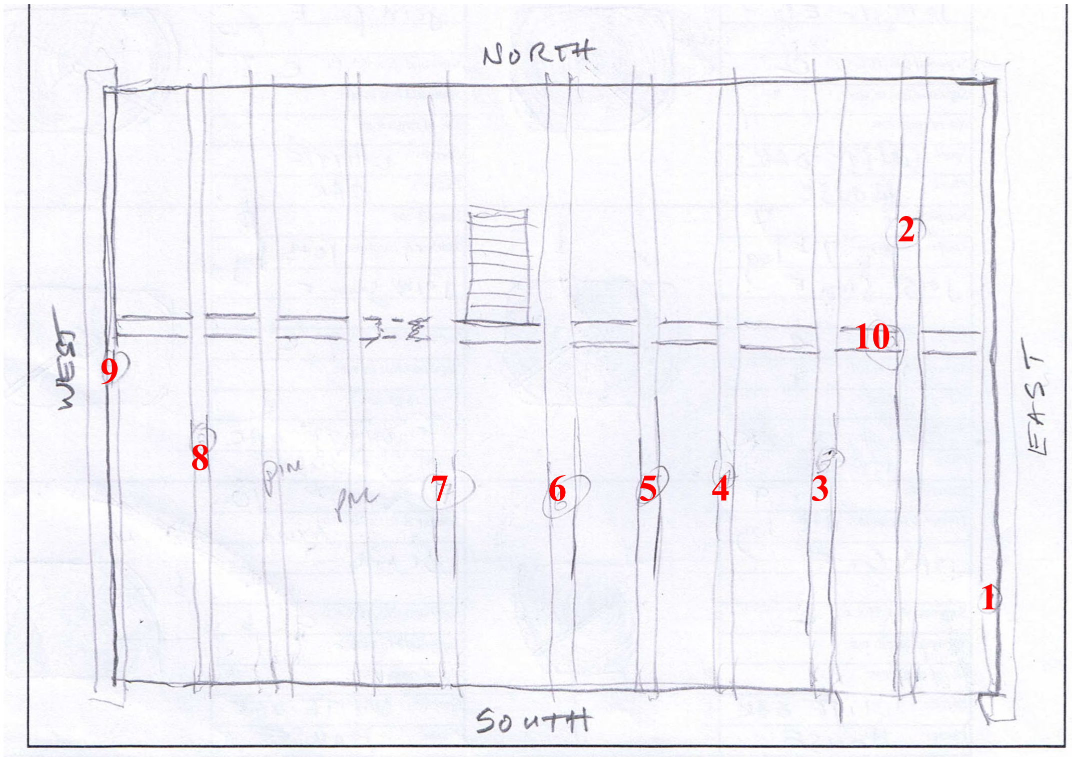
Table 2 gives an indication of the statistical reliability of the match between one sequence and another. This shows the *t*-value over the number of years overlap for each combination of samples in a matrix table. It should be born in mind that *t*-values with less than 80 rings overlap may not truly reflect the same degree of match and that spurious matches may produce similar values.

First, multiple radii have been cross-matched with each other and combined to form same-timber means. These are then compared with other samples from the site and any which are found to have originated from the same parent tree are again similarly combined. Finally, all samples, including all same timber and same tree means are combined to form one or more site masters. Again, the cross-matching is shown as a matrix table of *t*-values over the number of years overlaps. Reference should always be made to **Table 1** to clearly identify which components have been combined.

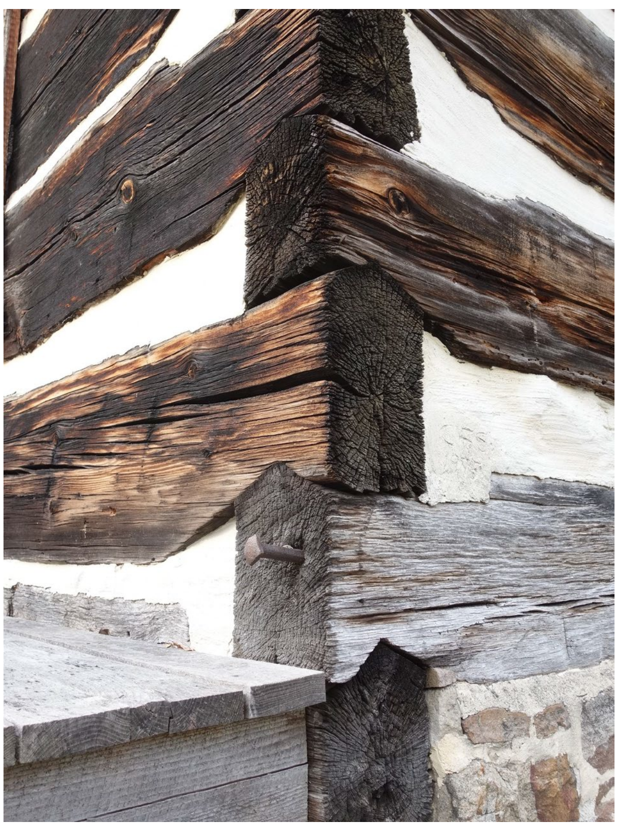
Table 3 shows the degree of cross-matching between the site master(s) with a selection of reference chronologies. This shows the county or region from which the reference chronology originated, the common chronology name together with who compiled the chronology with publication reference and the years covered by the reference chronology. The years overlap of the reference chronology and the site master being compared are also shown together with the resulting *t*-value. It should be appreciated that well replicated regional reference chronologies, which are shown in **bold**, will often produce better matches then with individual site masters or indeed individual sample sequences. Due to the fact that chronologies are still to be developed for many parts of the eastern seaboard of America, the number of chronologies are often limited to just one or two, and this information would alternatively be presented in the summary text.

Figures include a bar diagram which shows the chronological relationship between two or more dated samples from a phase of building. The site sample record sheets are also appended, together with any plans showing sample locations, if available.

Publication of all dated sites for English buildings are routinely published in *Vernacular Architecture* annually, but regrettably there is at the present time no vehicle available for the publication of dated American buildings. However, a similar entry is shown on the summary page of the report, and this hopefully could be used in any future publication of American dates. This does not give as much technical data for the samples dated, but does give the *t*-value matches against the relevant chronologies, provides a short descriptive paragraph for each building or phase dated, and gives a useful short summary of samples dated. These summaries are also listed on the website maintained by the Laboratory, which can be accessed at `www.Oxford-DendroLab.com`. The Oxford Dendrochronology Laboratory retains copyright of this report, but the commissioner of the report has the right to use the report for his/her own use so long as the authorship is quoted. Primary data and the resulting site master(s) used in the analysis are available from the Laboratory on request by the commissioner and bona fide researchers. The samples form part of the Laboratory archives, unless an alternative archive, such as the Colonial Williamsburg Foundation in association with the ODL, has been specified in advance.



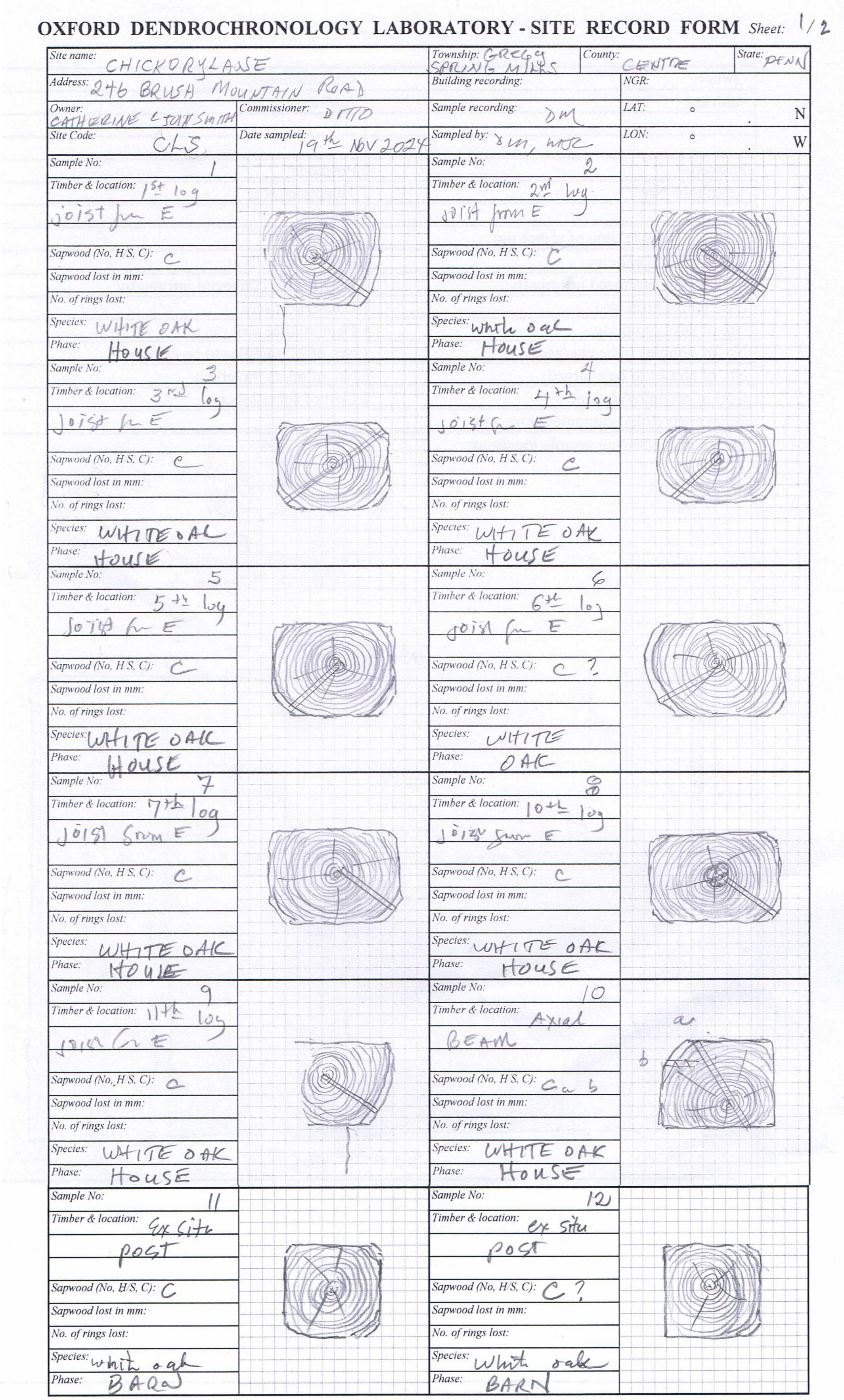
Sketch plan of cellar showing locations of timbers sampled (in red)



Details of south-east corner logs, bottom logs oak, others pine

Sampling cellar ceiling joists

Sampling barn offcut



OXFORD DENDROCHRONOLOGY LABORATORY - SITE RECORD FORM Sheet: 1/2

Site name: CHICKORY LANE		Township: GREGG SPRING MILLS	County: CENTRE / State: PENN
Address: 246 BRUSH MOUNTAIN ROAD		Building recording:	NGR:
Owner: CATHERINE & JON SMITH	Commissioner: DITTO	Sample recording: DM	LAT: ° . N
Site Code: CLS	Date sampled: 19th NOV 2024	Sampled by: DM, MJR	LON: ° . W

Sample No:	Timber & location:	Sapwood (No, H/S, C):	Sapwood lost in mm:	No. of rings lost:	Species:	Phase:
1	1st log joist fm E	C			WHITE OAK	HOUSE
2	2nd log joist from E	C			white oak	HOUSE
3	3rd log joist fm E	C			WHITE OAK	HOUSE
4	4th log joist fm E	C			WHITE OAK	HOUSE
5	5th log joist fm E	C			WHITE OAK	HOUSE
6	6th log joist fm E	C ?			WHITE	OAK
7	7th log joist from E	C			WHITE OAK	HOUSE
8	10th log joist from E	C			WHITE OAK	HOUSE
9	11th log joist fm E	C			WHITE OAK	HOUSE
10	Axial BEAM	C a b			WHITE OAK	HOUSE
11	ex situ POST	C			white oak	BARN
12	ex situ POST	C ?			white oak	BARN

Site record forms

Summary of Dating

The log house at Chicory Lane Farm sets on the side of a hill, adjacent to a frame barn, recently rebuilt. The house consists of a stone cellar with mainly oak log joists apart from two which are pine, roughly squared with a long off-centre axial beam. The ground floor ceiling and upstairs ceilings are of sawn pine joists, again with off centre axial beams. The roof consists of small scantling poles and appears to be original. The walls to the house above cellar level are of pine, with oak used for the first course. All logs are of boxed heart.

The timbers were assessed, and the logs did not have any obvious bark edge externally, and the pine logs were in variable condition. The internal joists did not have good bark edges, and therefore it was decided to concentrate on the ground floor joists, accessed from the cellar. Virtually all of the joists retained bark edge, and whilst all boxed heart, were sufficiently slow grown to have adequate ring counts, therefore all sampling was conducted in the cellar.

Samples were taken from nine joists (**cls1** – **cls9**), starting from the east end of the house, and also include the axial beam. Two samples were required from this to obtain bark edge on the second sample **cls10b** (Table 1).

Two salvaged timbers from the barn were also taken for analysis, these were cored and the offcuts will be returned to the site. They were labelled **cls11** and **cls12**, with bark edge and near bark edge.

First the two samples from the axial beam, **cls10a** and **cls10b**, were compared with each other and were found to match sufficiently well, despite the low t-value, and combined to form the same-timber mean sequence **cls10**.

The remaining samples were compared with this timber mean and two joists from the house were found to match together well: **cls1** and **cls3**. These were combined to form the same-tree mean **cls013**. Similarly, the two samples from the barn, **cls11** and **cls12**, were compared together and were found to match exceptionally well, and were combined to form the same-tree mean **cls112** (Table 2).

Next, all timber sequences were compared with the other joists and all were found to match extremely well together. They were combined to form the 206-ring site master **CLSx** (Table 2).

This was compared with a wide range of reference chronologies and was found to match conclusively, spanning the years 1612-1817 (Table 3). Matches were best with local Pennsylvanian chronologies.

All but one of the timbers sampled from the house retained bark edge. Nine timbers retained the complete ring for 1817 beneath the bark, representing the dormant winter season. Therefore, nine precise felling dates all from the winter of 1817/18 were found, aligning perfectly. One joist, **cls6**, was missing one ring likely due to being shaved with a tool when debarking the logs, and therefore finished at 1816 and an incomplete ring for 1817. This has produced an estimated date of 1817-18.

Such an outstanding group of timber felled at exactly the same time would strongly indicate that the trees were all felled in the winter of 1817/18 and that they were felled to construct the present house, which would have taken place in 1818.

Of the two timbers from the barn, one (**cls12**) with incomplete sapwood and another (**cls11**) was found to have the last measured ring for 1803. Given that the rings at the outer end of the sample were very narrow with little summer or late wood, it is possible that this ring was not fully formed and was cut down in the summer of 1803. Alternatively, it could be fully formed and was felled in the winter of 1803/4. For the sake of caution, a felling date of 1803-4 was given for this timber. And as **cls11** was from the same parent tree as **cls12**, this felling date could be applied to this timber as well. To be able to refine these dates would really need further samples from the barn.

It is worth noting that these two timbers were hewn, whereas other timbers saved from the barn were sawn and square-rule framed, which is more typical of the mid-nineteenth century which was the presumed date of the replaced barn. It is possible that this latter barn, recently replaced by the present standing barn, incorporated material from an earlier structure which predated the house. Without additioanl material it is impossible to say any more.

Acknowledgements

The dendrochronology was commissioned by Catherine Smith, and arranged by Michael Cuba. Virginia Cuba assisted with travelling and site work. Dr Ed Cook and Paul Krusic of the LDEO Dendrochronology Laboratory at Columbia University, New York, made available both published and unpublished reference chronologies.

References

Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, *Tree-Ring Bulletin*, **33**, 7-14

Chattaway, Margaret, 1952 'The Sapwood/Heartwood Transition', *Australian Forestry*, Vol XVI, No. 1, 25-34

Contributors of the International Tree-Ring Data Bank, IGBP PAGES/World Data Center for Paleoclimatology, NOAA/NCDC Paleoclimatology Program, Boulder, Colorado, USA.

Desch, H E, 1948 *Timber - Its Structure and Properties*, second edition, London

Gerry, Eloise, 1914 'Tyloses: their occurrence and practical significance in some American woods', *J. Agricultural Research*, Vol I, No. 6, 445-81

Kato, Hiroyuki, and Kishima, Tsnuneo 1965 'Some Morphological Observations of Tyloses' *Wood Research*, No. 36, 55-60

Miles, D H, 1997 The interpretation, presentation, and use of tree-ring dates, *Vernacular Architect*, **28**, 40-56

Munro, M A R, 1984 An Improved Algorithm for Crossdating Tree-Ring Series, *Tree Ring Bulletin*, **44**, 17-27

Table 1: Summary of Tree-Ring Dating

GREGG SPRING MILLS, CHICORYLANE, 246 BRUSH MOUNTAIN ROAD, CENTRE COUNTY, PENNSYLVANIA

Sample number & type		Species	Timber and position	Dates AD spanning	H/S date	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
Log house											
cls1	c	QUAL	1st log joist from E, ground floor	1626-1817	1802	15C	192	0.75	0.37	0.197	**Winter 1817/18**
* **cls2**	c	QUAL	2nd log joist from E, ground floor	1612-1817	1815	2C	206	0.64	0.18	0.226	**Winter 1817/18**
cls3	c	QUAL	3rd log joist from E, ground floor	1642-1817	1799	18C	176	0.74	0.23	0.190	**Winter 1817/18**
* **cls4**	c	QUAL	4th log joist from E, ground floor	1679-1817	1802	15C	139	0.93	0.26	0.219	**Winter 1817/18**
* **cls5**	c	QUAL	5th log joist from E, ground floor	1648-1817	1803	14C	170	0.77	0.32	0.158	**Winter 1817/18**
* **cls6**	c	QUAL	6th log joist from E, ground floor	1684-1816	1801	15	133	0.98	0.30	0.212	***circa* 1817-18**
* **cls7**	c	QUAL	7th log joist from E, ground floor	1695-1817	1798	19C	123	0.94	0.47	0.203	**Winter 1817/18**
* **cls8**	c	QUAL	10th log joist from E, ground floor	1678-1817	1806	11C	140	0.83	0.19	0.144	**Winter 1817/18**
* **cls9**	c	QUAL	11th log joist from E, ground floor	1634-1817	1807	24C	184	0.71	0.28	0.156	**Winter 1817/18**
cls10a	c	QUAL	Axial beam, ground floor	1625-1806	1706	10	182	0.65	0.29	0.149	**(Winter 1817/18)**
cls10b	c	QUAL	ditto	1775-1817	1796	21C	43	0.91	0.28	0.122	**Winter 1817/18**
* **cls10**		QUAL	Mean of **cls10a** + **cls10b**	1625-1817	1796	21C	193	0.68	0.32	0.143	**Winter 1817/18**
* **cls013**		QUAL	Same-tree mean of **cls1** + **cls3**	1626-1817	1800	17C	192	0.77	0.30	0.169	**Winter 1817/18**
Barn (salvaged timbers from re-built barn)											
cls11	c	QUAL	*Ex situ* post	1667-1803	1802	1C?	137	0.86	0.40	0.177	**1803-4**
cls12	c	QUAL	*Ex situ* post	1634-1801	1800	1	168	0.84	0.36	0.265	**(1803-4)**
* **cls112**		QUAL	Same-tree mean of **cls11** + **cls12**	1634-1803	1801	2	170	0.87	0.38	0.223	**1803-4**
*** = CLSx Site Master**				**1612-1817**			**206**	**0.83**	**0.18**	**0.144**	

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring: ¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); H/S bdry = heartwood/sapwood boundary - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; QUAL = *Quercus alba* (White oak), QURU = *Q rubra* (Red oak), PISP = *Pinus L.* (Southern yellow pine), LITU = *Liriodendron tulipifera L.* (Tulip-poplar),

Explanation of terms used in Table 1

The summary table gives most of the salient results of the dendrochronological process. For ease in quickly referring to various types of information, these have all been presented in Table 1. The information includes the following categories:

Sample number: Generally, each site is given a two or three letter identifying prefix code, after which each timber is given an individual number. If a timber is sampled twice, or if two timbers were noted at time of sampling as having clearly originated from the same tree, then they are given suffixes '**a**', '**b**', etc. Where a core sample has broken, with no clear overlap between segments, these are differentiated by a further suffix '**1**', '**2**', etc.

Type shows whether the sample was from a core 'c', or a section or slice from a timber's'. Sometimes photographs are used 'p', or timbers measured *in situ* with a graticule 'g'.

Species gives the four-letter species code used by the International Tree-Ring Data Bank, at NOAA. These are identified in the key at the bottom of the table.

Timber and position column details each timber sampled along with a location reference. This will usually refer to a bay or truss number, or relate to compass points or to a reference drawing.

Dates AD spanning gives the first and last measured ring dates of the sequence (if dated),

H/S bdry is the date of the heartwood/sapwood transition or boundary (if identifiable).

Sapwood complement gives the number of sapwood rings, if identifiable. The tree starts growing in the spring during which time the earlywood is produced, also known also as spring growth. This consists of between one and three decreasing spring vessels and is noted as *Spring* felling and is indicated by a ¼ C after the number of sapwood ring count. Sometimes this can be more accurately pin-pointed to very early spring when just a few spring vessels are visible. After the spring growing season, the latewood or summer growth commences, and is differentiated from the proceeding spring growth by the dense band of tissue. This summer growth continues until just before the leaves drop, in about October. Trees felled during this period are noted as *summer* felled (½ C), but it is difficult to be too precise, as the width of the latewood can be variable, and it can be difficult to distinguish whether a tree stopped growing in autumn or *winter*. When the summer growth band is clearly complete, then the tree would have been felled during the dormant winter period, as shown by a single C. Sometimes a sample will clearly have complete sapwood, but due either to slight abrasion at the point of coring, or extremely narrow growth rings, it is impossible to determine the season of felling.

Number of rings: The total number of measured rings included in the samples analysed.

Mean ring width: This, simply put, is the sum total of all the individual ring widths, divided by the number of rings, giving an average ring width for the series.

Mean sensitivity: A statistic measuring the mean percentage, or relative, change from each measured yearly ring value to the next; that is, the average relative difference from one ring width to the next, calculated by dividing the absolute value of the differences between each pair of measurements by the average of the paired measurements, then averaging the quotients for all pairs in the tree-ring series (Fritts 1976). Sensitivity is a dendrochronological term referring to the presence of ring-width variability in the radial direction within a tree which indicates the growth response of a particular tree is "sensitive" to variations in climate, as opposed to complacency.

Standard deviation: The mean scatter of a population of numbers from the population mean. The square root of the variance, which is itself the square of the mean scatter of a statistical population of numbers from the population mean. (Fritts 1976).

Felling seasons and dates/date ranges is probably the most important column of the summary table. Here the actual felling dates and seasons are given for each dated sample (if complete sapwood is present). Sometimes it will be noticed that often the precise felling dates will vary within several years of each other. Unless there is supporting archaeological evidence suggesting different phases, all this would indicate is either stockpiling of timber, or of trees which have been felled or died at varying times but not cut up until the commencement of the particular building operations in question. When presented with varying precise felling dates, one should always take the *latest* date for the structure under study, and it is likely that construction will have been completed for ordinary vernacular buildings within twelve or eighteen months from this latest felling date (Miles 1997).

Table 2: Matrix of *t*-values and overlaps for same-timber means and site masters

Components of timber **cls10**

Sample:	**cls10b**
Last ring date AD:	1817
cls10a	3.88 32

Components of timber **cls013**

Sample:	**cls3**
Last ring date AD:	1817
cls1	10.50 176

Components of timber **cls112**

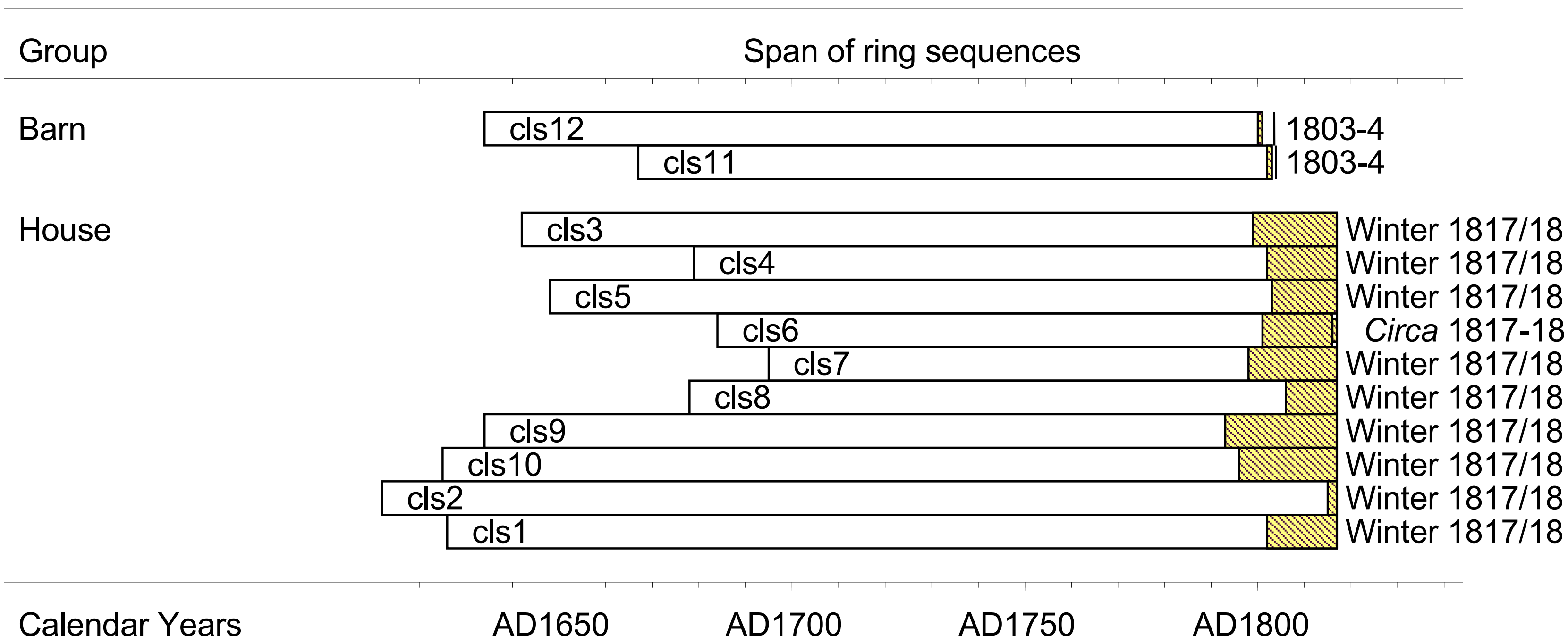
Sample:	**cls12**
Last ring date AD:	1801
cls11	12.51 135

Components of site master **CLSx**

Sample:	**cls4**	**cls5**	**cls6**	**cls7**	**cls8**	**cls9**	**cls10**	**cls013**	**cls112**
Last ring date AD:	1817	1817	1816	1817	1817	1817	1817	1817	1803
cls2	6.83 139	6.34 170	7.99 133	7.59 123	6.38 140	5.49 184	6.39 193	10.80 192	6.51 170
	cls4	6.72 139	7.10 133	8.83 123	9.34 139	5.79 139	5.55 139	8.40 139	9.69 125
		cls5	4.38 133	5.10 123	7.06 140	4.29 170	4.89 170	11.08 170	8.56 156
			cls6	8.42 122	6.01 133	4.62 133	3.85 133	7.74 133	9.83 120
				cls7	5.93 123	4.87 123	4.73 123	5.88 123	9.34 109
					cls8	4.45 140	5.49 140	7.70 140	8.80 126
						cls9	5.56 184	6.53 184	5.28 170
							cls10	5.41 192	3.04 170
								cls013	10.33 170

Table 3: Dating of site master **CLSx** (1612-1817) against reference chronologies at 1817

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap:*	*t-value:*
Virginia	Hanover Tavern	Columbia *pers comm*	WATCH	1595-1981	206	6.02
Virginia	Mountain Lake	World Data Bank	VA011	1552-1983	206	6.25
Pennsylvania	Morgan James Homestead, Chalfont	Cook *pers comm*	FORES	1458-1988	206	6.34
Pennsylvania	Emig Haus Haycock - House	Miles *in prep*	MJCx	1565-1807	196	6.70
Pennsylvania	East Pennsylvania Mod & Histo	World Data Bank - Ed Cook	EASTPA	1461-2004	206	7.02
Pennsylvania	Seegok	Columbia *pers comm*	SEEPA	1562-1983	206	7.86
Pennsylvania	FireTower Road Cook Forest	World Data Bank	PA006	1660-1981	158	7.88
Pennsylvania	Allen Seegar White Oak	Cook *pers comm*	ALLENS	1516-1983	206	9.96



Bar diagram showing dated timbers in chronological position